VEGETATION SURVEY OF BURGNER ACRES, EAST-CENTRAL ILLINOIS

BARBARA K. BLACKMORE AND JOHN E. EBINGER
Eastern Illinois University, Charleston

ABSTRACT. — This survey of woody vegetation of a ten acres woodlot, represents the first in a series of studies to determine long term vegetational succession. Thirty-four woody species are present on the site with white ash being the leading dominant. Slippery elm, shagbark hickory, hackberry and black walnut followed in order of Importance Value Index. The number of dead elms and living elms indicate that this site was once predominantly an elm forest. The site contains three well-defined areas: a heavily moved section which slopes gradually to Sycamore Creek, a somewhat less disturbed and moist area which slopes to a second loop of the creek, and a partially disturbed higher and drier section. The first area contains a few scattered relatively large specimens of shagbark hickory, black walnut, and several others. An abundance of shagbark hickory, hackberry, white ash, young elms and black walnut are present in the second area, while shagbark hickory, white ash and mockernut hickory predominate in the third.

Burgner Acres, a ten-acre woodlot located in east central Illinois, was donated to Eastern Illinois University in January 1955, by Helen Burgner Douglas and has been maintained undisturbed, except for a footpath, since that time. Six permanent plots were established not long after the property was acquired (Henderson and Damann, 1966), and in 1962 an ecology class ran several line transects. This present study is a complete survey of the woody vegetation that will make possible accurate comparisons and will allow an analysis of even the less important tree species.

DESCRIPTION OF THE WOODLOT

Burgner Acres is located in the center of Coles County about eight miles northwest of Charleston. The topography is gently rolling with a maximum difference of about 25 feet and the area is relatively well drained. Prior to its acquisition by Eastern Illinois University much of the northern portion was mowed frequently and the remainder was disturbed by various degrees of cutting. The woodlot contains three well-defined areas (Henderson and Damann, 1966): a heavily mowed area (A) which slopes gradually to Sycamore Creek, a somewhat less disturbed and moist area (B) which slopes to a second loop of the creek, and a partially disturbed higher and drier area (C).

METHOD OF STUDY

The entire woodlot was staked off into 50 foot square quadrats and the number, size and species of trees above four inches d.b.h. were recorded for each. Dead-standing and dead-downed trees were measured and identified when possible. Relative density, relative dominance (basal area), relative frequency (number of plots of occurence) and importance value (sum of relative density, relative dominance and relative frequency) was then calculated from the actual data to provide a better basis of comparison of the various species. These values were calculated not only for the entire woods but for each of the three areas outlined in the description of the woodlot. The terminology used is a modification of the procedures used by Curtis and McIntosh (1951).

One set of nested, circular quadrates 1/100 and 1/1,000 of an acre in size, were randomly located in each 50 foot square quadrat. The saplings (1-4 inches d.b.h.) were tallied on the larger and seedlings on the smaller quadrats. These seedlings were separated into those under one foot in height, and those over one foot in height but less than one inch d.b.h.

Results and Discussion

A total of thirty-four species were encountered on the woodlot, eight of which were understory trees or shrubs. These species, along with their density and frequency by size classes, are shown in Table 1. The twelve leading species encountered, with their relative values, average diameters and number of individuals per acre in broad diameter classes, are included in Table 2. The nomenclature of the species found in the woodlot follows that of Jones (1963).

Of the arborescent species found in Burgner Acres, white ash has the highest Importance Value; however, it ranks second to slippery elm in relative frequency and relative density. Many of the white ash trees are larger than elm, but the latter is more evenly distributed and more abundant throughout the woodlot. Slippery elm exceeds white ash in the number of trees present in the 4-6 inch class, and if the living and dead elm values are summed, it becomes readily apparent that this species was once the most important one present. All of the larger elm trees were killed by Dutch Elm disease and phloem necrosis and some of the small individuals are also dead or dying.

Shagbark hickory ranks third in Importance Value because of its high relative dominance. This species ranks highest in the 7-12 diameter class and second in the 13-24 class. Both hackberry and red haw have higher relative frequencies and relative densities, but the large number of small individuals of these two species accounts for their somewhat lower Importance Values. Black walnut, which ranks fifth in Importance Value, shows a pattern similar to that of shagbark hickory. There are several explanations for the relative lack of intermediate-sized individuals of these two species. Perhaps hackberry and red haw were able to reproduce and survive better during and immediately after the period of disturbance, and/or perhaps shagbark hickory and walnut were lumbered except for some larger trees left for nut production. The abundance of red haw throughout the woods indicates the lack of understory species and the relative openness of the woods. As other species reproduce, perhaps this species will become less important.

The importance of white oak and mockernut hickory is chiefly due to the large size of individual trees. Again, this is probably due to lack of reproduction during the period of disturbance and/or to selective cutting. Red mulberry is more abundant than either of these two but ranks tenth because of its very low dominance value.

The large number of dead elms is an important feature of the woodlot. In Table 1, only the dead-standing elms were listed. The dead-downed trees were not included because accurate identification was not always possible. When the living elms are totaled with the dead-standing elms, it becomes evident that at one time

TABLE 1. — **Density Per Acre and Frequency of Woody Species by Height or Diameter Class. The species symbol will be used to identify species in subsequent tables and figures.**

Scientific Name	Common Name	Symbol	Height Class					Diameter Class			
			Density			Frequency %		1″-4″		4″ +	
			<1′	>1′<1″ dbh	Total	<1′	>1′<1″ dbh	Density	Frequency %	Density	Frequency %
Fraxinus americana	White ash	WA	305	398	703	16.6	24.6	161	54.6	22.32	54
Ulmus rubra	Slippery elm	SE	146	312	458	11.3	18.6	206	65.3	23.83	65
Carya ovata	Shagbark hickory	SH	252	133	385	15.3	9.3	25	16.0	14.18	39
Celtis occidentalis	Hackberry	H	378	279	657	19.3	18.0	137	50.6	16.97	48
Juglans nigra	Black walnut	BW	.....	19	19	.....	2.0	18	6.0	9.18	36
Ulmus sp. (dead)	Elm	E	.....	.....	.....	.....	.....	.....	.....	10.11	31
Crataegus mollis	Red haw	RH	153	33	186	4.0	3.3	58	32.0	16.51	45
Quercus alba	White oak	WO	166	26	192	11.3	2.0	.....	.....	3.02	15
Carya tomentosa	Mockernut hickory	MH	.....	6	6	.....	0.6	7	4.6	4.30	18
Morus rubra	Red mulberry	RM	6	.....	6	0.6	.....	13	10.6	4.41	22
Quercus macrocarpa	Bur oak	BO	19	6	25	2.0	0.6	6	4.6	1.27	7
Carya cordiformis	Bitternut hickory	BH	133	93	226	8.6	5.3	19	10.6	2.90	12
Cercis canadensis	Red bud	R	113	13	126	4.6	1.3	5	2.0	2.20	9
Maclura pomifera	Osage orange	OO	.....	6	6	.....	0.6	1	0.6	1.97	5
Prunus serotina	Black cherry	BC	259	79	338	10.6	4.0	19	12.6	2.09	9
Platanus occidentalis	Sycamore	S	.....	.....	.....	.....	.....	.....	.....	0.34	2
Gleditsia triacanthos	Honey locust	HL	19	.....	19	2.0	.....	1	1.3	1.62	7
Quercus imbricaria	Shingle oak	SO	26	6	32	2.6	0.6	3	2.0	1.16	3
Tilia americana	Linden	L	.....	.....	.....	.....	.....	.....	.....	0.69	1
Quercus rubra	Red oak	RO	.....	13	13	.....	1.3	.....	.....	0.34	1
Robinia pseudoacacia	Black locust	BL	6	.....	6	0.6	.....	3	0.6	1.04	1
Acer saccharum	Sugar maple	SM	139	146	285	4.0	4.6	16	5.3	0.69	2
Malus ioensis	Iowa crabapple	IC	39	73	112	1.3	2.6	36	5.3	0.69	1
Viburnum prunifolium	Black haw	B	219	59	278	10.6	4.0	13	10.0	0.34	1
Sassafras albidum	Sassafras	Sa	6	.....	6	0.6	.....	.....	.....	0.46	1

Acer negundo	Box elder	BE	.....	.....	.....	.....	.....	.....	.....	0.23	1
Salix nigra	Black willow	BW	.....	.....	.....	.....	.....	.....	.....	0.11	1
Crataegus crusgalli	Cockspur thorn	CT	.....	.....	.....	.....	.....	1	1.3	0.11	1
Quercus muhlenbergii	Chinquapin oak	CO	26	12	38	1.3	0.6	1	0.6	.....	.....
Euonymus atropurpureus	Wahoo	W	26	26	52	1.3	2.0	11	3.3	.....	.....
Zanthoxylum americanum	Prickly ash	PA	.....	86	86	.....	0.6	.....	.....	.....	.....
Rhus radicans	Poison ivy	PI	711	358	1,069	14.0	10.6	.....	.....	.....	.....
Cornus racemosa	Gray dogwood	GD	.....	.....	.....	.....	.....	1	0.6	.....	.....
Symphoricarpos orbiculatus	Coralberry	C	372	5,913	6,285	21.3	80.6	.....	.....	.....	.....
Sambucus canadensis	Common Elder	CE	.....	6	6	.....	0.6	.....	.....	.....	.....
Total			3,519	8,101	11,620	.....	.....	761	.....	143.08	.....

TABLE 2. — Diameter Classes, Average Diameter, Relative Values and Importance Value for Leading Dominants.

	Number of Trees Per Acre by Diameter Class									
	4-6	7-12	13-24	25+	Total	Av. Diam.	Rel. Freq.	Rel. Den.	Rel. Dom.	I.V.
WA	14.2	4.3	3.4	.5	22.4	10.1	12.3	15.6	15.3	43.2
SE	22.3	1.5	.....	.....	23.8	5.0	14.8	16.6	4.1	35.5
SH	2.8	7.2	4.1	.1	14.2	11.6	8.9	9.9	13.2	32.0
H	13.7	2.6	.6	.1	17.0	6.8	10.9	11.9	5.5	28.3
BW	2.0	1.5	5.4	.4	9.3	14.5	8.2	6.4	13.3	27.9
E	3.3	3.0	3.4	.4	10.1	13.5	7.1	7.0	12.6	26.7
RH	14.0	2.1	.5	.....	16.6	5.8	10.1	11.5	3.8	25.4
WO	.1	.1	1.4	1.4	3.0	23.9	3.5	2.1	11.9	17.5
MH	.....	1.4	2.9	.....	4.3	14.8	4.1	3.0	6.5	13.6
RM	4.2	.2	.....	.....	4.4	5.0	5.0	3.1	.8	8.9
BH	.9	1.3	.7	.....	2.9	11.1	2.7	2.0	2.5	7.2
BO	.5	.2	.4	.1	1.2	14.7	1.5	.9	1.9	4.3
Others	9.6	3.2	1.3	.3	14.4	9.4	10.9	10.0	8.6	29.5
Totals	87.6	28.6	24.1	3.3	143.6	.....	100.0	100.0	100.0	300.0

Burgner Acres was predominantly an elm forest. The dead elms show a basal area of 14.8 square feet per acre and a density of 15.1 trees per acre, while the totals for living and dead elms are 18.0 square feet per acre and 39.0 trees per acre. A few hickory, oak, sycamore, and white ash logs were also found.

Many saplings and seedlings of ash, elm and hackberry were found throughout the woods along with relatively large numbers of shagbark hickory, red haw, mulberry and black cherry. Bitternut hickory and red bud were reproducing quite abundantly in areas B and C, and young sugar maples predominated in parts of area C. All species except sugar maple are rather shade-intolerant and will decrease in importance as the canopy becomes more dense.

Many shrubs were common throughout the woods. Indian currant (*Symphoricarpos orbiculatus*) was found in nearly every plot and is by far the most abundant of the shrubby species. Elderberry (*Sambucus canadensis*), poison ivy (*Rhus radicans*) and blackberry (*Rubus spp.*) are fairly common in the most disturbed area (A) while many specimens of burning bush (*Euonymus atropurpureus*) are found in the plots along Sycamore Creek.

The herbaceous plants were not included in this study, but spring herbs are abundant throughout the woods both in number of species and number of individuals. Bloodroot (*Sanguinaria canadensis*), Dutchman's breeches (*Dicentra cucullaria*), spring beauty (*Claytonia virginica*), water-leaf (*Hydrophyllum spp.*), trout lily (*Erythronium al-*

bidum), and purple trillium (*Trillium recurvatum*) are among the abundant, conspicuous species. Trout lily is present in especially large numbers in the third area described above while bluebells (*Mertensia virginica*) are fairly common along the second loop of Sycamore Creek.

If the data are calculated separately for each area mentioned in the description of the woodlot, distinct differences can be seen (TABLE 3). In this table the relative values, average diameters and the number of trees per acre by diameter class are listed for the 12 species with the highest Importance Value for the entire woodlot. Also the Importance Values of the 12 most important species in the three areas are presented in FIGURE 1. In this figure the areas are compared with each other and with the entire woodlot.

The order of importance of some species is quite different in the three areas. In area A (2.4 acres) which is the most disturbed, hackberry is the most important species. Almost all trees of this species are in the 4-6 inch diameter class. Many walnut trees are present in this area, and dead elms slightly exceed living elms in importance. White ash ranks eighth in this area while it ranks first for the entire woodlot, and shagbark hickory also ranks lower here than for the entire woodland.

In area B (3.8 acres), drainage is better, and white ash becomes most important while hackberry drops to sixth and black walnut to seventh in importance. Shagbark hickory, a dry area species, becomes second in importance while slippery elm ranks third and is represented by numerous individuals in the 4-6 inch diameter class.

White ash is again the most important species in the third and driest area (2.4 acres). However, mockernut hickory, a species not found in area A and tenth in importance in area B, ranks second here, and white oak ranks fifth instead of eighth or lower. These two species indicate the drier, upland nature of this portion of the woods. On one portion of the slope to Syca-

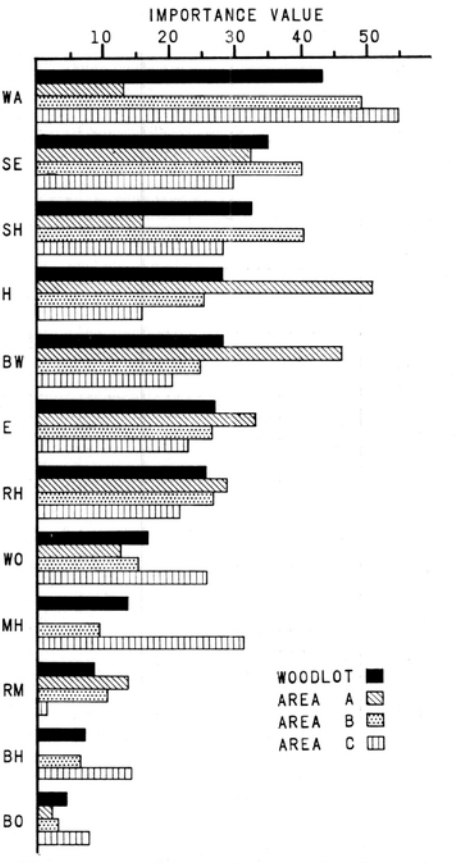

FIGURE 1. — Comparison of the Importance Values of the leading dominants in the entire woodlot and in the three areas.

TABLE 3. — Diameter Classes, Average Diameter, Relative Values and Importance Value of the leading dominants in the three areas.

	Species	Number of Trees Per Acre by Diameter Class						Rel. Freq.	Rel. Den.	Rel. Dom.	I.V.
		4-6	7-12	13-24	25+	Total	Av. Diam.				
	WA	4.6	.4	.4	.....	5.4	6.1	6.3	5.1	1.8	13.2
	SE	12.9	1.3	.....	.....	14.2	4.9	16.0	13.2	2.9	32.1
	SH	.4	.8	1.7	.4	3.3	18.3	3.5	3.1	9.7	16.3
	H	22.5	2.5	.....	.4	25.4	6.5	18.1	23.7	9.4	51.2
	BW	2.5	2.5	7.1	.4	12.5	14.2	12.5	11.7	22.1	46.3
Area	E	1.2	3.3	3.3	.4	8.2	16.1	6.3	7.8	18.8	32.9
	RH	6.2	4.6	1.3	.....	12.1	8.2	10.4	11.3	7.1	28.8
A	WO	.....	.....	1.3	.4	1.7	24.4	2.1	1.6	8.7	12.4
	MH	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	RM	5.0	.4	.....	.....	5.4	4.8	7.6	5.1	1.1	13.8
	BH	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	BO	.8	.....	.....	.....	.8	4.3	1.4	.8	.1	2.3
	Others	14.2	1.3	1.7	.8	18.0	10.8	16.0	16.7	18.3	51.0
	Total	70.3	17.1	16.8	2.8	107.0	.....	.....	.....	.....	.....
	WA	10.8	6.1	5.8	1.1	23.8	12.5	12.6	14.2	22.6	49.4
	SE	30.8	1.8	.....	.....	32.6	5.0	15.6	19.6	5.0	40.2
	SH	4.7	10.8	6.1	.....	21.6	11.1	11.7	13.0	16.2	40.9
	H	12.9	3.2	.5	.....	16.6	6.7	10.5	10.0	4.5	25.0
	BW	2.6	1.6	5.0	.3	9.5	13.7	7.5	5.7	10.8	24.0
Area	E	4.5	3.2	4.2	.3	12.2	12.7	7.2	7.3	11.8	26.3
	RH	20.5	1.3	.3	.....	22.1	5.0	9.3	13.3	3.4	26.0
B	WO	.3	.3	1.1	1.6	3.3	23.0	3.0	1.9	10.2	15.1
	MH	.....	1.3	1.8	.....	3.1	13.9	3.3	1.9	4.0	9.2
	RM	5.8	.3	.....	.....	6.1	5.1	6.0	3.6	1.0	10.6
	BH	1.8	.5	.8	.....	3.1	10.7	2.7	1.9	2.2	6.8
	BO	.5	.3	.....	.3	1.1	15.3	.9	.6	1.5	3.0
	Others	6.8	4.0	.8	.3	11.9	9.6	9.6	7.1	6.7	23.4
	Total	102.0	34.7	26.4	3.9	167.0	.....	.....	.....	.....	.....
	WA	29.2	5.4	2.5	.....	37.1	7.1	16.3	26.0	12.8	55.1
	SE	18.3	1.3	.....	.....	19.6	4.9	12.5	13.7	3.2	29.5
	SH	2.1	7.9	3.3	.....	13.3	10.7	8.2	9.4	10.4	28.0
	H	6.3	1.7	1.3	.....	9.3	8.1	6.0	6.4	4.1	16.5
	BW	.4	.4	4.2	.4	5.4	17.3	6.0	3.8	11.0	20.8
Area	E	3.8	2.5	2.1	.4	8.8	12.3	7.6	6.1	9.1	22.8
	RH	11.3	.8	.....	.....	12.1	4.9	11.4	8.5	2.0	21.9
C	WO	.....	.....	2.1	2.1	4.2	24.8	5.4	3.0	17.5	25.9
	MH	.....	2.9	7.5	.....	10.4	14.9	8.7	7.3	15.8	31.8
	RM	.8	.....	.....	.....	.8	4.5	1.1	.6	.1	1.8
	BH	.4	3.8	1.3	.....	5.5	11.5	4.9	3.8	4.9	13.6
	BO	.4	.4	1.3	.....	2.1	16.7	2.7	1.5	3.9	8.1
	Others	9.2	3.8	1.3	.....	14.3	7.4	9.2	9.9	5.2	24.3
	Total	82.2	30.9	26.9	2.9	142.9	.....	.....	.....	.....	.....

more Creek, large numbers of seedlings and saplings of sugar maple are present. If these individuals reach reproductive size, the third area (and possbily more) will probably become dominated by this species.

The amount of understory in area A indicates that rapid reforestation of the mowed area is taking place. Some generalizations have already been made concerning differences in drainage pattern and the resulting differences in importance of species. Some differences between areas will no doubt be maintained, but the upland portions of areas B and C will probably become similar.

The authors hope that complete surveys will be conducted every five years and the data recorded along with some environmental data of intervening years. Positive statements could then be made concerning the direction of change in the vegetation and perhaps this information could be projected to other woods in similar locations. Information recorded over a period of years might be applied at some future time, not only to our purely scientific understanding of vegetational dynamics, but also to reclamation of land in this part of the state for recreational purposes.

ACKNOWLEDGMENTS

Sincere thanks are expressed to Dr. Donald A. Jenni, Department of Zoology, and to members of the Beta Beta Beta Honorary Biological Society of Eastern Illinois University for staking off the woodlot into 50 foot square quadrats.

LITERATURE CITED

CURTIS, J. T. and R. P. MCINTOSH. 1951. An upland forest continuum in the prairie-forest border of Wisconsin. Ecol. 32:476-496.

HENDERSON, S., and K. E. DAMANN. 1966. Burgner Acres natural area of Eastern Illinois University. Trans. Ill. Acad. Sci. 59:281-286.

JONES, G. N. 1963. Flora of Illinois. Amer. Midl. Nat. Monogr. 7:vi + 401.

Manuscript received August 11, 1966.